

Wheatland Conservation Area Inc.

P.O. Box 2015, Swift Current, Saskatchewan. S9H 4M7

Ph. # (306) 773-4775

2021 Progress Report Strategic Field Program #20190400

Project Title: An Assessment of Annual Forage Varieties in Saskatchewan



Principal Investigators: Terry Kowalchuk, Murray Feist and Shannon Chant, Saskatchewan Ministry of Agriculture, Mitchell Japp, Sask Barley, Bryan Nybo, Wheatland Conservation Area Inc., Bill Biligetu, University of Saskatchewan, Robin Lokken, Conservation Learning Centre, Lana Shaw, South East Research Farm

Report Prepared by: Amber Wall, Wheatland Conservation Area Inc.

Site Correspondence: wcawall@sasktel.net

Project Identification

1. **Project Title:** An Assessment of Annual Forage Varieties in Saskatchewan
2. **Project Number:** 20190400 SFP
3. **Contractor Undertaking the Project:** Wheatland Conservation Area Inc.
4. **Project Location:** Swift Current, Clavet, Redvers and Prince Albert, SK
5. **Project start and end dates (month & year):** April 1, 2020 to March 31, 2023
6. **Project contact person & contact details:**
Amber Wall, Research Technician
Wheatland Conservation Area Inc.
P.O. Box 2015, Swift Current, SK, S9H 4M7
Phone: 306-773-4775
Email: wcawall@sasktel.net

Objectives and Rationale

7. Project objectives:

- The objective of this project is to evaluate and compare commonly grown and commonly available varieties of barley, oats, wheat, triticale and some mixtures for forage yield and quality along with newer crop varieties for their potential as annual forages.
- Recent shifts in spring weather patterns and extended periods of drought combined with increased year to year climatic variability has resulted in more dual-purpose use (grain/green feed) of cereal crops in livestock production systems. This adaptation allows for greater flexibility and increases the overall economic resiliency of mixed farming operations while helping to ensure adequate feed supplies during dry periods when perennial forage yields are low.
- Although the Saskatchewan Variety Performance Group (SVPG) initiated a small annual forage test in spring 2019 to test new varieties, there is still a knowledge gap with respect yield and quality measures for i) some current popular annual forage varieties, and ii) top grain varieties which have the potential to be used as annual forage but have not yet been widely used for that purpose.
- Data from this project will complement data collected in the SVPG trial

8. Project Rationale:

- Perennial forages rely heavily on early spring precipitation. Frequent spring drought and increased climatic variability has led producers to increase their use of annual forages to supplement inconsistent perennial forage yields.
- Based on call logs at the Agriculture Knowledge Centre, from May 1, 2018 – May 1, 2019, 278 calls were related to annual forages/yellow feed/green feed/silage, 6 of which were specific to variety and 94 for corn/perennial/seed production.
- The data shows that producers are increasingly responding to potential reductions in hay supply in late spring by seeding an annual cereal as an insurance feed supply. In many cases they seed what is commonly available at the time. Depending on the year, these crops can be used as green

feed or, if growing conditions for their perennial crops improve, the cereals can be harvest for grain.

- Additional information about the performance of common annual cereal varieties is required to help producers make more informed decisions about which cereals and which varieties can provide the best value for both grain and livestock feed in comparison to those that have been bred for forage production
- The use of annual forages is increasing due to uncertain feed supplies caused by increased climatic variability
- Having regional yield and quality data will support recommendations for the use of annual forages and help producers make more informed decisions about which varieties they can rely on for both grain and feed. This in turn will add resiliency to their overall operations by providing more flexibility for adaptation.

Methodology and Results

9. Methodology:

This project consists of 24 entries at 4 locations over 3 years. The plots are randomized by species and replicated 3 times. Plot size varies depending on the seeding equipment at each location, generally in the range of 4-12 m². The locations are targeted near cattle producing areas across a range of soil zones. Wheatland Conservation Area, Swift Current (Dry Brown), South East Research Farm, Redvers (long season Black), University of Saskatchewan, Clavet (Dark Brown) and Conservation Learning Centre, Prince Albert (short season Black). Ministry staff (cereal and forage specialists, livestock specialists and regional livestock and feed specialists), breeders and industry specialists were consulted for suggested entries. Suggestions have been narrowed down based on the following criteria:

- varieties that are not in the current SVPG trial,
- varieties that are a popular grain or forage type, and
- varieties that are expected to remain in the market for the foreseeable future.
- Check varieties will allow for linkage and direct comparison with varieties included within the SPVG.

Design: RCBD with three replicates

Treatments: Varieties listed below

<u>Barley</u>	<u>Oats</u>	<u>Mixtures</u>	<u>Wheat</u>	<u>Triticale</u>
AB Advantage (check)	CDC Haymaker (check)	CDC Haymaker (check)	AAC Innova (check)	Taza (check)
CDC Maverick	Ore3542M	KWS ProPower + CDC Baler	CDC Plentiful	Bunker
CDC Cowboy	CDC Ruffian	CDC Arborg + CDC Maverick	Pasteur	Proghorn
AAC Synergy	SO-1	CDC Austenson + CDC Haymaker	Sadash	
CDC Bow	CS Camden	CDC Haymaker + CDC Horizon		
CDC Fraser		CDC Haymaker + CDC Horizon + forage rape		

Crop Management: All sites and treatments were seeded in both 2020 and 2021, required data was collected and all treatments harvested. A list of operations is included below (table 1) including harvest stage and seeding rate (table 2).

Table 1. List of Operations at each site 2020, 2021, 2022.

Location	Swift Current			Clavet			Redvers			Prince Albert		
	2020	2021	2022	2020	2021	2022	2020	2021	2022	2020	2021	2022
Seed Date	May 15	May 6	--	May 15	May 22	--	May 12	varied	--	May 20	May 17	--
Wheat & Triticale								April 29				
Oats								May 1				
Barley & Mixtures								May 6				
Seed Rates	Same seeding rate at all sites (based on seeds/m2)											
Fertility	Based on recommended rates for each region											
N	60-80			45			60			40		
P	30-40			0			23			30		
K	0			0			8			0		
S	10			0			0			0		
Weed control	Pre-seed burn-off prior to emergence to control any perennial weeds, winter annuals or variable natural populations											
Heading notes	At maturity											
Lodging ratings	Before harvest											
Stage at harvest	Oats used as an indicator crop											
Harvest Dates	July 30	July 22	--	July 30	July 3	--	July 23	July 19	--	Aug 11	Aug 3	--
	Aug 4		--	Aug 5	Aug 5	--	July 27	July 22	--	Aug 18		--
								July 27				
Quality Analysis	Subsamples sent to Central Testing for feed analysis											

Table 2. Seeding rates and harvest stage of each crop.

Harvest Stage	Crop	Seed Rate
soft dough	Barley	@250 plants/m2
late milk	Oats	@250 plants/m2
early dough	Wheat	@250 plants/m2
soft dough	Triticale	@310 plants/m2
oats as indicator crop	Fall rye	@100 plants/m2
	Baler oat	@125 plants/m2
	Arborg Oat	@125 plants/m2
	Maverick Barley	@125 plants/m2
	Haymaker Oat	@125 plants/m2
	Austenson Barley	@125 plants/m2
	Haymaker Oat	@125 plants/m2
	Horizon Pea	@85 plants/m2
	Haymaker Oat	@95 plants/m2
	Horizon Pea	@31 plants/m2
	Gorilla forage rape	@32 plants/m2

Data Collected: All data required was collected at all sites (Appendices table 9).

- Moisture at harvest
- Days to Heading
- Lodging Ratings
- Actual stage at biomass
- Feed Analysis (CP, TDN, Ca, P, K, Mg, Na, ADF, NDF, ADI-CP, ADIN)
- Dry matter yield

Data Analyses:

- Data was analysed by WCA
- Tables were made to include all effects regardless of whether responses were significant.

Results

10. General Conditions at each location

Table 3. Mean monthly temperatures and precipitation compared to long-term averages.

Location	Year	May	June	July	August	Avg. / Total
<i>-----Mean Temperature (°C)-----</i>						
Swift Current	2020	10.9	16.6	18.2	19.5	16.3
	2021	9.5	18.4	21.7	18	16.9
	Long-term	10.9	15.3	18.2	17.6	15.5
Redvers	2020	10.5	16.8	19.2	18.5	16.2
	2021	10.0	18.7	20.8	17.5	16.8
	Long-term	12.0	16.0	19.0	18.0	16.3
Prince Albert	2020	9.2	13.4	17.6	16.1	14.1
	2021	10.1	18.3	20.3	17.0	16.4
	Long-term	10.6	17.0	19.5	18.2	16.3
Clavet	2020	11.4	15.3	18.8	18.6	16.0
	2021	10.6	18.8	21.9	17.8	17.3
	Long-term	11.8	16.1	19	18.2	16.3
<i>-----Precipitation (mm)-----</i>						
Swift Current	2020	36.3	80	62.5	6.5	185
	2021	35	29.6	38.9	55.8	159
	Long-term	51.2	77.1	60.1	47.4	236
Redvers	2020	22.9	59.7	47.8	36.1	166
	2021	42.2	107.3	58	57	265
	Long-term	60.0	91.0	78.0	64.0	293
Clavet	2020	69.5	94.5	34.6	26.5	225
	2021	41.2	39	8.5	42.2	131
	Long-term	36.5	63.6	53.8	44.4	198
Prince Albert	2020	68.4	91.4	32.2	33.2	225
	2021	30.1	80.3	8.6	59.9	179
	Long-term	45.4	75.9	46.8	45.0	213

According to the Saskatchewan Crop Report, in 2021 Redvers, Swift Current, and Clavet went into spring seeding with below adequate moisture levels, while Prince Albert had a 5% surplus.¹ Swift Current and Redvers received scattered rain showers throughout seeding followed by cool and dry conditions, therefore emergence was delayed and soil moisture diminished very quickly. Prince Albert was able to seed into good soil moisture the third week of May, followed by timely rains throughout the spring. Clavet was the last location to be seeded due to cool May temperatures, but received a good rain in the same week. All locations received precipitation the last week of May getting all trial locations off to a good start in terms of establishment.

Crops continued to develop normally and were in good condition until June when limited to no rainfall, wind and warm temperatures began to slow growth. Meanwhile, the Northeast continued to receive light rainfall and while growth quickened still remained slightly behind other locations. By the middle of June, soil conditions at Swift Current and Clavet were deteriorating quickly. Swift Current also experienced

¹ <https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/market-and-trade-statistics/crops-statistics/crop-report/previous-crop-reports>

higher than average temperatures, dry and windy weather for the remainder of June causing crops to rapidly advance, resulting in estimated yields to be below average. Clavet had cooler than normal temperatures and needed warmth to support the later seeded crop. Due to a later seeding date, crops at Clavet were developmentally behind compared to Swift Current when the crop experienced the higher than average day time temperatures in the end of June. Meanwhile, Redvers received heavy amounts of rainfall, cool temperatures and continued to develop normally/slightly behind normal.

By this time, soil conditions also began to deteriorate at Prince Albert, but crops remained in fairly good condition. Into the first week of July the trial at Swift Current had experienced irreparable damage and biomass harvest was likely to be a low yielding, but fair quality if the crop continued to fill. Crops at Redvers, Clavet and Prince Albert began to advance quickly in the heat and were also in need of rain to fill properly.

This time last year crops remained in normal stages of development, but many regions were also experiencing drought and extremely high temperatures. 2021 brought an earlier than normal biomass harvest in Swift Current, which took place for all crops July 22nd as damage was irreversible and yields were already estimated to be lower than the rest of the region and provincial average. Redvers was first to biomass harvest wheat July 19th and finished up harvest the last week of July. In the Northeast, wheat faired the heat better than oats and barley, but all crops were ahead of normal developmental stages, although were still expected to be good quality. Clavet received hail prior to harvest, but it was thought not to have affected the plots. Crops were short, and matured rapidly in the dry conditions, so were ready to be harvested the first few days of August. Crops were also drought stressed in Prince Albert and rapidly matured to be harvested August 3rd.

Environmental conditions varied each year and mean monthly temperatures and precipitation compared to the long-term average are listed in Table 3 above. Accumulative precipitation per year can be seen in Figure 1.

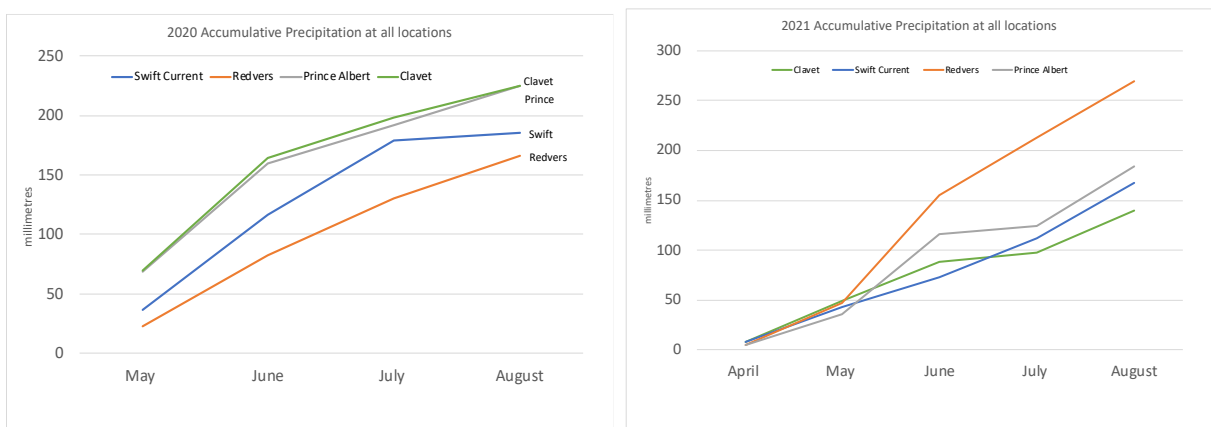


Figure 1. Accumulative precipitation at each location, 2020 and 2021.

11. Field Results

Nutrient requirements for cattle change with age, stage of production, sex, breed, environmental conditions and basal diet quality and amount. For the purposes of this report, feed analyses are evaluated based on the Beef Cattle Research Council requirements and their feed value estimator (BCRC).² Variation in production management and cow type will affect nutrient requirements, therefore it is important to test feed annually and consult with your local livestock and feed extension specialists on what is best for a specific operation.

8-site year averages (Table 4, Table 10).

Over 8-site years, barley crude protein averaged 9.3%. TDN (67.2%) was well above the 55-60-65 rule of thumb suggesting a high energy feed and resulting NDF (48.9%) and ADF (29.4%) values suggest a feed source high in quality and intake. In terms of nutritional value, barley was low in calcium and phosphorus and did not meet the required portions, or ratio and may need to be supplemented. Barley yield averaged over all varieties was 7,067 kg/ha, with the variety Maverick yielding the highest (7,751 kg/ha). Of the barley varieties in this test, the forage varieties (Advantage, Maverick, and Cowboy) all out-yielded the malt varieties (Synergy, Bow, Fraser).

Oat crude protein averaged 9.5%. TDN (64.2%) was well above the 55-60-65 rule of thumb suggesting a high energy feed and resulting NDF (53.2%) and ADF (32.2%) values suggest a feed source high in quality and intake/digestibility. In terms of nutrient values, oats were inadequate in calcium and the resulting calcium to phosphorus ratio suggests feed may need to be supplemented. Overall oat yield averaged 7,174 kg/ha, slightly higher than the overall barley average. Haymaker oat was the highest yielding variety when averaged across 8 site years (7,656 kg/ha), which can be explained by Haymaker having forage or green feed yield advantage over other oats due characteristics like large plump seeds and larger, wider flag leaves compared to non-forage oat varieties.³ Haymaker was also a later maturing variety (61 DTH) compared to the other varieties.

Overall triticale crude protein over 8-site years averaged 9.1%. TDN (64.9%) was well above the 55-60-65 rule of thumb suggesting a high energy feed and resulting NDF (51.7%) and ADF (31.6%) values suggest a feed source high in quality and intake. In terms of nutritional value, triticale was low in calcium and may need to be supplemented. Triticale forage yield averaged 6,999 kg/ha. Pronghorn was the highest yielding triticale variety when averaged over all 8 site years (7,305 kg/ha), likely due to being fairly a fairly drought tolerant forage variety.

When averaged over 8-site years and all varieties, wheat crude protein (10%) was higher than other monoculture treatments. TDN (65.8%) was well above the 55-60-65 rule of thumb suggesting a high energy feed and resulting NDF (50.9%) and ADF (30.8%) values suggest a feed source high in quality and intake. In terms of nutritional value, wheat was low in calcium and phosphorus may need to be supplemented. Wheat yield averaged 6,392 kg/ha and was the lowest yielding species compared to barley, oats, triticale and the mixtures. Innova was the highest yielding wheat variety when averaged across the 8 site years (6,670 kg/ha) and is the variety in this test that is most commonly used for forage.

² <https://www.beefresearch.ca/research/feed-value-estimator.cfm>

³ <https://www.secan.com/system/files/CDC%20Haymaker%20Jan%202016%20TB.pdf>

The 8-site year averages of mixtures ranged in crude protein from 9.1% to 10.5% depending on what types of species were included in each mix. This group has the largest range in data due to having a forage pea in two of the treatments in an attempt to provide a protein boost compared to the cereal mixtures, which they did by an increase of 0.6%-0.7% over the check variety. Total digestible nutrients (TDN) were particularly high for the barley-oat treatments, but all treatments were above 62.7% with little variation between treatments. In terms of nutrient values, cereal mixtures were inadequate in calcium and phosphorus and the resulting calcium to phosphorus levels were not an acceptable ratio for feed requirements. However, the pea-oat mixtures were high in calcium. Although, still lower amounts than desired, the resulting ratios are thought to be acceptable in order to avoid winter tetany (death). When mixtures were averaged overall treatments, ADF (32.2%) suggests feed would result in in good forage intake and NDF levels (53%) suggest high energy feed sources. Overall, the Haymaker mixture check out yielded the other treatments, but yield did vary by location. Barley-Oat treatments were generally a high yielding mixture, but overall had no advantages in terms of other data taken over the barley, or oat monoculture.

Table 4. Forage DM yield, DTH, lodging and nutrient analyses, 8-site year averages (Swift Current, Redvers, Clavet, Prince Albert, 2020-2021).

Site Years	Variety	Crop	Days to Heading	Lodging Score (1-9)	Forage DM Yield (kg/ha)	Feed Analysis					
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)
8	AB Advantage (check)	Barley	62	1	6,956	9.9	29.7	49.5	66.9	0.26	0.19
8	CDC Maverick	Barley	62	1	7,751	9.0	28.9	48.3	67.8	0.24	0.19
8	CDC Cowboy	Barley	61	1	7,434	9.0	30.2	50.0	66.3	0.23	0.19
8	AAC Synergy	Barley	62	1	6,769	9.2	28.1	46.9	68.6	0.27	0.18
8	CDC Bow	Barley	63	1	6,747	9.2	29.5	49.0	67.1	0.29	0.18
8	CDC Fraser	Barley	63	1	6,748	9.3	29.8	49.9	66.8	0.23	0.18
8	Overall Barley Average	Barley	62	1	7067	9.3	29.4	48.9	67.2	0.25	0.18
8	CDC Haymaker (check)	Oat	61	1	7,656	9.6	33.9	56.5	62.4	0.22	0.19
8	Ore3542M	Oat	57	1	7,487	9.3	31.4	52.7	65.1	0.19	0.21
8	CDC Ruffian	Oat	58	1	7,228	9.7	32.4	51.6	64.0	0.21	0.20
8	CDC SO-1	Oat	57	1	6,840	9.4	30.8	52.5	65.7	0.24	0.19
8	CS Camden	Oat	57	1	6,661	9.6	32.6	52.4	63.8	0.23	0.19
8	Overall Oat Average	Oat	58	1	7174	9.5	32.2	53.2	64.2	0.22	0.20
8	Taza (check)	Triticale	56	1	6,974	9.1	31.9	52.5	64.6	0.16	0.19
8	Bunker	Triticale	56	1	6,717	9.3	32.4	52.5	64.1	0.25	0.24
8	Pronghorn	Triticale	56	1	7,305	9.0	30.5	49.9	66.0	0.25	0.23
8	Overall Triticale Average	Triticale	56	1	6999	9.1	31.6	51.7	64.9	0.22	0.22
8	AAC Innova (check)	Wheat	59	1	6,670	9.6	31.4	52.0	65.0	0.14	0.17
8	CDC Plentiful	Wheat	59	1	6,366	10.5	30.2	51.2	66.4	0.17	0.18
8	Pasteur	Wheat	57	1	6,009	10.2	30.7	49.4	65.8	0.15	0.19
8	Sadash VB	Wheat	58	1	6,525	9.9	30.8	51.2	65.8	0.14	0.17
8	Overall Wheat Average	Wheat	58	1	6392	10.0	30.8	50.9	65.8	0.15	0.18
8	CDC Haymaker (check)	mixture	59	1	7,614	9.8	33.4	55.3	63.0	0.24	0.20
8	KWS ProPower+CDC Baler	mixture	61	1	6,679	9.7	32.6	54.5	63.8	0.26	0.20
8	CDC Arborg+CDC Maverick	mixture	59	1	7,444	9.1	29.6	49.4	67.0	0.24	0.19
8	CDC Austenson+CDC Haymaker	mixture	61	1	7,552	9.6	30.4	51.0	66.2	0.22	0.20
8	CDC Haymaker+CDC Horizon	mixture	61	2	6,985	10.5	33.5	53.6	62.8	0.39	0.21
8	CDC Haymaker+CDC Horizon+forage brassica	mixture	60	2	7,043	10.4	33.6	54.5	62.7	0.35	0.20
8	Overall Mixture Average	mixture	60	1	7220	9.9	32.2	53.0	64.3	0.28	0.20

Fall rye (KWS ProPower) mixed with oats (CDC Baler) is of interest to livestock producers as a spring seeded winter annual will continue growing after the first cut and can then be grazed and/or overwintered for further forage. Other findings on this mixture:

- Lowest yielding mixture when averaged over 8 site years (figure 2).
- This treatment had a high crude protein (9.7%) compared to other treatments including monocultures (table 4).
- TDN (63.8%) suitable for a cow mid-late pregnancy.

- Being spring seeded the hybrid fall rye is characterized by large leaf biomass, rather than heading out like other species, and explains why it was lower yielding than other 2 species cereal mixtures.
- Yield did vary by location. At Prince Albert specifically, this treatment consistently yielded well compared to other mixes (table 8), and resulted in only a few hundred kg/ha less than the check variety each year and out-yielded the rest of the mixes.

A mixture of oats (CDC Arborg) and barley (CDC Maverick) did not increase the overall protein content of the mix as a result of Arborg oats having improved protein compared to other oat varieties. Both species are tall plants and Arborg has good lodging resistance, which may have been beneficial for Maverick barley, which is prone to lodging.

- Neither this barley-oat mixture, or Maverick barley monoculture resulted in significant lodging in this study, likely due to dry environmental conditions.
- Crude protein for this mix (9.1%) was less than the check variety, Haymaker (9.8%) and only 0.1% higher than the Maverick barley monoculture (9.0%).
- There were very little differences in ADF and NDF compared to the other treatments, but this mixture did result in TDN (67%) 4.0% higher than the Haymaker check (63%).
- This barley-oat mixture yielded well (7,444 kg/ha), but less than the Haymaker oat check (7,614 kg/ha) and Maverick barley monoculture (7,751 kg/ha).
- Barley and oat plants in this treatment appeared well balanced.

The second barley (CDC Austenson) and oat (CDC Haymaker) mixture was included due to the difference in maturities between the two varieties and was thought would result in improved protein in the barley. Austenson barley also has improved lodging resistance and is mixed with a much taller variety of oat.

- The mixture did not show any lodging, nor did the Haymaker check. We cannot contribute this to Austenson barley being in the mix, but rather little variation in yield and treatment effects due to the growing season conditions.
- Crude protein (9.6%) was 0.2% less than the Haymaker check, but 0.5% higher than the other barley-oat mixture.
- This mixture yielded 7,552 kg/ha, slightly less than the Haymaker oat check, but slightly more (108 kg/ha) than the first barley-oat mixture.
- Of the 2 barley-oat mixes, the treatment including Haymaker oats resulted in a slight yield and protein advantage when averaged over 8-site years.
- Visually, this mixture appeared to be made up mostly of Haymaker oats, which is a tall variety with large and wide flag leaf area and may explain the slight increase in this mixture over the other. However, this varied by location.
- Barley-oat mixtures were very well-suited to Clavet and yielded higher than the check variety both years.

A forage blend that includes a pulse is also a common recommendation to improve protein. A mixture of oats (CDC Haymaker) and peas (CDC Horizon) increased protein (10.5%) by 0.7% compared to the check. A second blend of Haymaker oats, Horizon peas and Gorilla forage rape was included to potentially further increase protein, as well as energy (NDF) and improve overall forage quality.

- The 3-species blend increased crude protein by 0.6% compared to the check.
- Both treatments were high in TDN (63%) and pulse mixtures resulted in TDN similar to the check.
- The additional brassica species did not result in differences that suggest a feed source higher in energy compared to the pea-oat mixture.
- Pulse mixtures were low in terms of 8-site years yield averages compared to other mixtures and the additional brassica resulted in a negligible yield increase.
- Pulse mixture yield did vary by location.
- Swift Current and Clavet are likely the most well-suited area for pulse mixtures. These treatments yielded similar to the check variety, unlike the other locations where the pulse mixtures were lower than the oat check by 1000-3000 kg/ha.
- Resulting calcium levels very high in the pulse mixtures compared to other treatments.

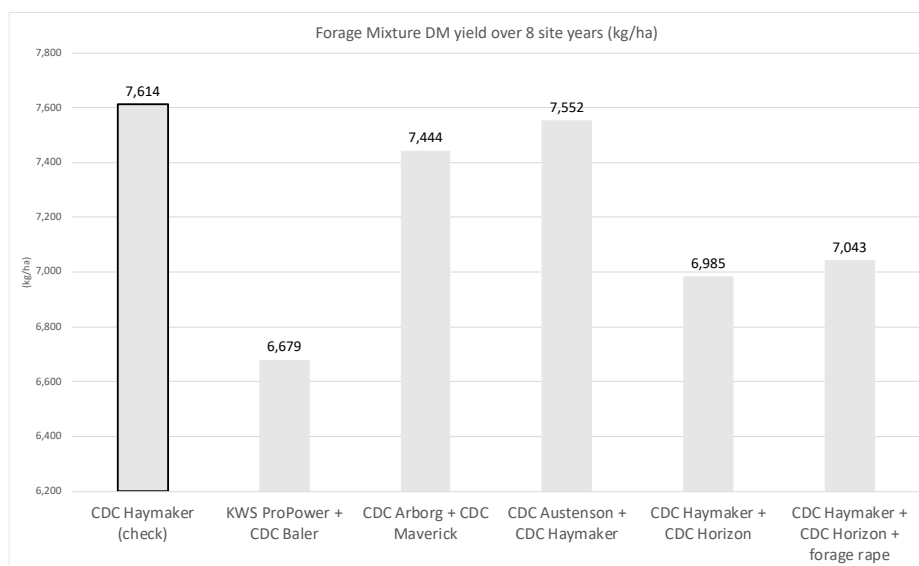


Figure 2. Forage mixture DM yields (kg/ha) averaged over 8 site years

Swift Current preliminary results (table 5)

Each year all plots were seeded early May and harvested late July/early August. However, harvest took place 12 days earlier in 2021 as a result of heat and drought conditions rapidly advancing crop development. Weather conditions in year 2 led to an early harvest and is likely the reason for a higher quality and much lower yielding sample in 2021. As a result of an earlier harvest, less heat damage occurred (ADIN) and resulted in a higher quality feed in 2021 compared to 2020. This difference in environmental conditions from year to year also likely created variability in yield data.

- Crude protein values were much higher in 2021 (12-15.5%) than 2020 (6.8-8.6%).
- TDN was higher in 2021 and above the 55% minimum each year.
- ADF was lower in 2021, but suggest good potential for high forage intake each year.
- The nutrient analyses suggest most treatments were low in calcium (Ca) and phosphorus (P) and high in potassium (K) and may need to be supplemented.

Table 5. Yield and nutrient analysis results, Swift Current 2020, 2021.

Year:	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021				
Swift Current	Yield (kg/ha)		CP		TDN		Ca		P		K		Mg		Na		ADF		NDF		ADI-CP		ADIN	
AB Advantage (check)	11,488	3,067	7.5	13.8	63	67	0.26	0.45	0.22	0.21	1.9	1.3	0.13	0.24	0.04	0.03	33	30	54	48	3.8	2.6	51	41
CDC Maverick	13,119	3,161	7.5	12.3	65	71	0.23	0.36	0.25	0.22	1.6	1.2	0.14	0.22	0.03	0.04	31	26	54	45	3.4	2.4	46	38
CDC Cowboy	11,948	3,062	6.5	12.0	61	72	0.24	0.30	0.23	0.23	1.9	1.3	0.14	0.22	0.05	0.04	36	25	56	45	3.0	2.3	45	37
AAC Synergy	11,198	2,695	7.2	12.8	68	68	0.24	0.41	0.22	0.20	1.4	1.2	0.13	0.21	0.03	0.03	28	28	48	49	4.7	2.3	65	36
CDC Bow	12,789	2,775	7.2	13.2	61	69	0.27	0.42	0.21	0.20	1.7	1.2	0.12	0.20	0.03	0.03	35	28	57	50	4.5	2.3	64	37
CDC Fraser	11,640	2,554	7.3	12.8	64	67	0.20	0.36	0.21	0.21	1.8	1.3	0.12	0.20	0.02	0.03	32	29	54	51	3.7	2.5	50	40
CDC Haymaker (check)	12,363	3,937	7.6	12.8	57	67	0.17	0.34	0.26	0.26	2.8	2.1	0.10	0.20	0.01	0.05	39	30	61	54	3.2	1.8	42	29
Ore3542M	13,697	2,863	7.6	11.7	62	68	0.13	0.31	0.29	0.27	2.3	1.8	0.11	0.21	0.03	0.09	34	29	54	51	3.3	2.1	43	34
CDC Ruffian	13,579	2,903	7.7	12.1	58	69	0.15	0.33	0.28	0.26	2.3	1.9	0.11	0.19	0.01	0.03	38	27	59	46	3.1	2.0	41	32
SO-1	13,663	2,271	7.9	12.1	62	71	0.16	0.38	0.27	0.25	2.4	1.6	0.12	0.23	0.02	0.05	34	26	54	48	3.2	1.6	42	26
CS Camden	10,850	2,619	7.0	12.6	60	69	0.16	0.35	0.26	0.27	2.6	1.9	0.11	0.19	0.01	0.03	37	28	57	46	3.1	3.0	45	48
AAC Innova (check)	7,810	2,740	8.0	12.0	61	67	0.10	0.21	0.21	0.20	1.7	1.1	0.09	0.15	0.00	0.01	35	29	56	51	3.4	2.0	42	32
CDC Plentiful	5,819	2,383	8.4	14.8	65	74	0.09	0.19	0.23	0.27	1.4	1.3	0.09	0.14	0.01	0.02	32	23	49	41	3.7	2.2	44	35
Pasteur	7,012	2,650	8.4	15.5	64	71	0.11	0.27	0.21	0.25	1.3	1.3	0.11	0.17	0.00	0.01	33	26	55	47	3.1	2.1	37	34
Sadash	6,637	3,278	7.5	14.1	62	69	0.09	0.18	0.21	0.22	1.5	1.4	0.09	0.13	0.01	0.02	34	28	55	48	3.5	1.7	46	27
Taza (check)	6,954	3,232	8.6	13.0	64	72	0.12	0.19	0.25	0.27	1.5	1.4	0.09	0.12	0.01	0.01	33	25	52	43	3.3	2.4	39	39
Bunker	6,514	2,673	7.8	13.8	63	69	0.10	0.25	0.23	0.26	1.3	1.1	0.09	0.16	0.00	0.01	34	27	54	47	3.2	2.7	42	44
Pronghorn	8,145	2,871	6.8	13.9	64	72	0.16	0.26	0.21	0.27	1.3	1.4	0.13	0.16	0.17	0.01	33	25	53	44	3.1	2.3	47	36
CDC Haymaker (check)	13,556	3,624	8.2	14.2	56	68	0.18	0.39	0.28	0.25	3.0	1.8	0.11	0.23	0.01	0.07	40	29	63	53	3.6	2.1	45	34
KWS ProPower + CDC Baler	12,225	2,378	7.3	12.8	59	70	0.17	0.33	0.24	0.24	2.4	1.7	0.11	0.19	0.01	0.03	37	27	60	53	2.3	1.7	30	26
CDC Arborg + CDC Maverick	13,459	2,372	8.4	12.8	61	70	0.18	0.39	0.25	0.22	2.2	1.4	0.12	0.23	0.02	0.04	35	27	56	48	3.7	2.4	45	38
CDC Austenson + CDC Haymaker	13,798	2,735	7.0	14.6	57	69	0.16	0.36	0.26	0.25	2.3	1.8	0.10	0.21	0.01	0.04	39	27	62	51	3.6	1.9	52	30
CDC Haymaker + CDC Horizon	16,434	3,461	8.2	13.8	58	68	0.18	0.51	0.28	0.24	2.8	1.8	0.11	0.23	0.01	0.05	38	29	60	51	2.9	1.7	35	27
CDC Haymaker + CDC Horizon + forage rape	15,441	3,492	8.6	13.5	57	68	0.19	0.43	0.26	0.24	2.8	1.8	0.11	0.22	0.01	0.07	39	29	63	51	3.3	1.9	38	31

Swift Current 2021 yields resulted in little variation between treatments and were lower than 2020 yields due to a combination of extreme drought and heat. In 2020, pulse-cereal mixtures out yielded all other treatments with the highest yielding treatment resulting from the pea-oat mixture (16,343 kg/ha). The pea-oat mixture had a 21% increase over the check variety, followed by the pea-oat-brassica mixture (15,441 kg/ha); a 14% increase over the check variety. In 2021, the check variety, Haymaker oat was the highest yielding mixture (3,634 kg/ha), followed closely by the pea mixtures. The only varieties to out-yield the check variety in 2021 were Sadash wheat (3,278 kg/ha) and Maverick barley (3,161 kg/ha). Neither barley-oat mixture out-yielded the top yielding barley monoculture in either year at Swift Current. However, the barley-oat mixture that includes Haymaker oat did consistently yield higher than the Arborg oat mixture. Haymaker oat appears to have larger and wider leaves, is a tall plant and results in an overall greater biomass than other oat varieties at this location. Maverick barley was also the top yielding barley variety each year.

Top yielding varieties at Swift Current in 2020 (CV=13.8%) from each species:

- Maverick barley (13,119 kg/ha)
- Ore3542M oat (13,697 kg/ha), SO-1 oat (13,663 kg/ha)
- Innova wheat (7,810 kg/ha)
- Pronghorn triticale (8,145 kg/ha)
- Haymaker oat + Horizon pea (16,434 kg/ha)

Top yielding varieties in Swift Current in 2021 (CV=9.9%) from each species include:

- Maverick barley (3,161 kg/ha)
- Haymaker oat (3,937 kg/ha), and mixture check (3,624 kg/ha)
- Sadash wheat (3,278 kg/ha)
- Taza triticale (3,232 kg/ha)

Clavet preliminary results (table 6)

Seeding and harvest dates at Clavet were the same as Swift Current in 2020, but Clavet was seeded 2 weeks later than Swift Current in 2021. Both locations experienced similar weather conditions and

resulted in similar yields. With the cool temperatures after seeding, emergence was delayed, but all treatments were well established. With the exception of the pea mixtures, calcium and phosphorus levels were low. The mixtures were also high in Sodium. The difference in environmental conditions from year to year could create variability in yield and quality data.

- Crude Protein was higher in 2021 (11.2-14.5%) compared to 2020 (8.1-12%).
- TDN was high both years and had an overall range of 63-75%.
- ADF was higher in 2020 (27-34%) than 2021 (23-30%) but suggest good potential for high forage intake each year
- The nutrient analyses suggest most treatments were low in calcium (Ca), phosphorus (P), and Magnesium (Mg), high in potassium (K) and may need to be supplemented.

Table 6. Yield and nutrient analysis, Clavet 2020-2021.

Clavet	Year:		2020		2021		2020		2021		2020		2021		2020		2021		2020		2021		2020		2021	
	Yield (kg/ha)		CP	TDN	Ca	P	K	Mg	Na	ADF	NDF	ADI-CP	ADIN													
AB Advantage (check)	9,996	3,196	9.4	13.8	67	71	0.22	0.27	0.17	0.19	2.2	1.6	0.19	0.30	0.34	0.36	30	26	48	48	3.5	2.3	37	37		
CDC Maverick	10,129	3,737	8.1	11.4	66	71	0.19	0.26	0.16	0.15	2.0	1.4	0.18	0.29	0.31	0.30	30	26	49	47	3.8	3.3	47	52		
CDC Cowboy	10,554	3,825	9.5	12.2	66	71	0.20	0.22	0.17	0.17	2.2	1.5	0.19	0.26	0.32	0.27	31	25	49	45	3.7	2.5	39	40		
AAC Synergy	10,558	3,579	9.0	11.6	70	72	0.24	0.31	0.17	0.16	1.7	1.3	0.17	0.27	0.25	0.21	27	25	44	46	4.2	2.8	47	44		
CDC Bow	10,071	3,281	9.3	11.2	67	71	0.29	0.33	0.15	0.16	1.9	1.4	0.19	0.26	0.29	0.17	29	26	47	47	4.3	2.7	48	43		
CDC Fraser	10,539	3,321	10.4	12.1	68	71	0.18	0.26	0.16	0.18	2.1	1.4	0.17	0.27	0.31	0.25	29	25	47	47	4.3	3.9	41	63		
CDC Haymaker (check)	9,003	3,123	10.7	12.7	63	67	0.16	0.27	0.17	0.17	2.3	2.5	0.18	0.24	0.66	0.14	34	30	55	52	4.3	2.5	40	39		
Ore3542M	8,166	3,437	10.5	11.7	65	68	0.13	0.25	0.18	0.19	2.0	2.4	0.15	0.25	0.63	0.25	32	29	51	51	4.0	2.3	38	37		
CDC Ruffian	8,680	3,129	10.6	13.7	64	71	0.16	0.24	0.18	0.17	2.1	2.5	0.17	0.22	0.64	0.17	32	26	51	48	3.6	3.6	34	58		
SO-1	8,503	2,746	10.1	12.0	68	70	0.17	0.34	0.17	0.17	2.0	2.3	0.19	0.29	0.60	0.15	29	27	51	52	3.5	2.8	34	45		
CS Camden	8,512	2,947	11.6	13.5	65	69	0.17	0.29	0.20	0.18	1.9	2.3	0.21	0.25	0.57	0.09	31	28	50	46	4.5	3.2	38	51		
AAC Innova (check)	9,633	3,153	9.7	13.3	66	71	0.13	0.15	0.17	0.19	2.0	1.4	0.15	0.24	0.03	0.04	30	26	50	47	3.0	2.0	31	32		
CDC Plentiful	8,898	2,606	10.5	14.5	66	75	0.13	0.15	0.19	0.21	2.0	1.3	0.14	0.19	0.02	0.02	31	22	49	41	3.1	2.2	30	35		
Pasteur	9,341	2,504	10.6	14.4	68	74	0.13	0.16	0.17	0.19	1.6	1.3	0.16	0.27	0.02	0.03	29	23	49	43	3.2	2.1	31	33		
Sadash	9,012	3,347	9.9	13.3	67	75	0.13	0.15	0.16	0.19	1.9	1.5	0.17	0.25	0.02	0.05	30	22	48	45	3.6	2.3	37	36		
Taza (check)	10,805	3,365	9.0	12.7	64	72	0.17	0.18	0.16	0.20	2.1	1.6	0.15	0.21	0.03	0.01	32	25	54	46	3.4	2.6	38	42		
Bunker	10,799	2,817	9.2	11.0	63	69	0.15	0.20	0.15	0.18	1.8	1.2	0.16	0.23	0.02	0.01	34	28	53	50	3.3	2.0	36	33		
Pronghorn	11,387	2,949	9.5	11.5	68	70	0.14	0.20	0.17	0.17	1.8	1.4	0.16	0.26	0.03	0.01	29	26	46	47	3.3	2.1	35	34		
CDC Haymaker (check)	8,732	2,717	10.6	13.3	63	67	0.16	0.32	0.16	0.16	2.2	2.5	0.17	0.25	0.70	0.07	34	30	55	53	3.7	2.6	35	42		
KWS ProPower + CDC Baler	7,766	2,100	9.9	13.0	64	68	0.17	0.29	0.17	0.16	2.4	2.4	0.17	0.24	0.47	0.07	32	28	55	50	3.7	2.3	38	38		
CDC Arborg + CDC Maverick	10,491	3,436	9.3	13.3	68	73	0.18	0.26	0.16	0.17	1.7	2.2	0.19	0.23	0.45	0.12	28	24	45	45	4.6	3.5	49	56		
CDC Austenson + CDC Haymaker	10,108	3,254	9.7	14.5	67	72	0.16	0.23	0.16	0.17	2.1	2.2	0.16	0.21	0.31	0.08	29	25	47	46	3.9	2.0	39	31		
CDC Haymaker + CDC Horizon	8,477	2,374	12.0	13.8	64	67	0.36	0.41	0.17	0.16	2.2	2.5	0.22	0.26	0.46	0.08	32	30	50	53	3.5	2.6	29	41		
CDC Haymaker + CDC Horizon + forage rape	8,084	2,905	11.9	13.6	63	67	0.30	0.43	0.18	0.17	2.2	2.3	0.22	0.25	0.62	0.05	33	30	52	51	4.7	3.1	40	49		

Clavet 2021 yields resulted in little variation between treatments and were lower than 2020 yields due to a combination of extreme drought and heat. In 2020 (Clavet) the highest yielding treatment was Pronghorn triticale (11,387 kg/ha) and out-yielded the check variety by 6% and is known to be a drought tolerant forage variety. Cowboy (10,554 kg/ha) a forage barley and Synergy, a malt barley (10,558 kg/ha) were top yielding barley varieties both years. Oat, wheat and triticale yields varied from year to year, while mixture yields followed similar trends. Fall rye mixed with oats was not well-suited for this area being the lowest yielding mixture both years, but the barley-oat mixtures consistently yielded the highest and pulse-cereal mixes yielded similar to the check variety both years. All barley treatments, as well as both barley-oats mixtures out yielded their check variety.

Top yielding varieties at Clavet in 2020 (CV=8.4%) from each species include:

- Synergy barley (10,558 kg/ha), Cowboy barley (10,554 kg/ha) and Fraser barley (10,539 kg/ha)
- Haymaker oat (9,003 kg/ha)
- Innova wheat (9,633 kg/ha)
- Pronghorn triticale (11,387 kg/ha)
- Arborg oat + Maverick barley (10,491 kg/ha)

Top yielding varieties in Clavet in 2021 (CV=18.7%) from each species include:

- Cowboy barley (3,825 kg/ha)
- Ore3542M oat (3,437 kg/ha)
- Sadash wheat (3,347 kg/ha)
- Taza triticale (3,365 kg/ha)
- Arborg oat + Maverick barley (3,436 kg/ha)

Redvers preliminary results (table 7)

Seeding dates at Redvers varied in 2021. Wheat and triticale were seeded April 29th followed by oats on May 1st and lastly barley and mixtures on May 6th. Compared to 2020 this was almost 2 weeks earlier, although crops were harvested at approximately the same time each year. Most crops were of good quality at Redvers, with the exception of the triticale, which had protein below 7% in 2021. Low magnesium, high sodium and high ADF in 2021, compared to 2020 could lead to poor digestibility, although values were still under 45%.

- Crude Protein was similar in 2021 (6.8-11.1%) compared to 2020 (7.9-9.8%). However, barley-oat mixtures were low in protein in 2021, but adequate (7.2%-7.3%).
- TDN was slightly higher in 2020 (58-69%) compared to 2021 (53-61%).
- ADF was lower in 2020 (27-39%) compared to 2021 (34-41%), which may result in lower forage intake.
- The nutrient analyses suggest most treatments were low in calcium (Ca), phosphorus (P), and Magnesium (Mg) and may need to be supplemented.

Table 7. Yield and nutrient analysis, Redvers 2020-2021.

Year:	2020		2021		2020		2021		2020		2021		2020		2021		2020		2021		2020		2021	
	Yield (kg/ha)	CP	TDN	Ca	P	K	Mg	Na	ADF	NDF	ADI-CP	ADIN												
Redvers																								
AB Advantage (check)	9,917	6,488	8.8	9.3	69	57	0.20	0.26	0.15	0.13	1.0	1.4	0.16	0.20	0.31	0.38	27	39	44	64	4.6	2.1	52	33
CDC Maverick	8,933	6,699	8.6	8.4	68	59	0.21	0.21	0.16	0.13	0.9	1.2	0.18	0.20	0.31	0.28	28	37	44	59	4.5	1.7	52	27
CDC Cowboy	9,097	6,314	8.9	8.5	68	56	0.20	0.24	0.15	0.12	1.0	1.4	0.18	0.22	0.41	0.42	28	40	45	64	4.5	1.5	51	24
AAC Synergy	9,374	5,399	8.4	8.5	69	57	0.25	0.31	0.13	0.11	0.9	1.1	0.17	0.20	0.31	0.28	28	39	43	61	4.0	1.8	48	28
CDC Bow	8,476	5,805	8.8	7.7	69	55	0.25	0.32	0.15	0.11	0.9	1.0	0.16	0.19	0.24	0.28	28	41	44	63	4.4	1.8	50	29
CDC Fraser	8,860	5,047	8.5	8.2	69	56	0.21	0.25	0.15	0.11	1.0	1.2	0.17	0.19	0.30	0.25	28	40	45	62	4.9	1.9	58	31
CDC Haymaker (check)	9,140	6,358	8.4	8.7	61	55	0.22	0.21	0.15	0.14	1.0	1.9	0.19	0.16	0.64	0.50	35	41	57	66	1.3	2.0	16	32
Ore3542M	8,204	5,474	8.9	7.9	65	56	0.19	0.17	0.19	0.11	1.0	2.0	0.20	0.13	0.71	0.72	31	40	54	64	1.9	1.9	21	30
CDC Ruffian	8,182	5,722	8.5	8.0	60	53	0.21	0.22	0.16	0.11	1.2	2.1	0.18	0.14	0.74	0.54	36	43	56	65	1.8	2.0	21	32
SO-1	7,949	5,047	9.0	8.7	66	57	0.25	0.22	0.16	0.14	1.2	2.2	0.23	0.18	0.70	0.54	31	39	54	60	2.0	2.0	22	32
CS Camden	7,709	5,465	9.4	7.2	62	54	0.24	0.23	0.16	0.09	1.3	2.2	0.21	0.15	0.72	0.40	35	42	56	64	1.8	1.3	19	21
AAC Innova (check)	7,845	6,816	8.7	9.0	60	57	0.18	0.16	0.13	0.12	1.1	1.8	0.18	0.10	0.03	0.02	36	39	58	61	3.1	1.4	35	22
CDC Plentiful	6,389	6,825	8.7	8.4	58	54	0.22	0.17	0.12	0.11	1.2	1.7	0.18	0.09	0.02	0.02	39	41	59	62	2.8	1.9	33	31
Pasteur	6,894	6,432	9.8	9.3	60	55	0.23	0.17	0.14	0.11	1.2	1.7	0.20	0.11	0.02	0.01	36	41	59	63	2.9	1.2	30	20
Sadash	7,600	6,428	9.3	9.2	61	56	0.18	0.15	0.14	0.13	1.1	1.9	0.17	0.12	0.02	0.02	35	40	57	62	3.1	1.5	34	23
Taza (check)	7,179	7,470	9.2	6.4	63	54	0.18	0.18	0.16	0.09	1.0	1.6	0.17	0.09	0.02	0.01	33	42	54	65	3.4	1.5	37	24
Bunker	7,487	7,424	9.5	6.8	63	55	0.89	0.18	0.63	0.10	4.2	1.2	0.63	0.10	0.03	0.01	34	41	54	62	3.8	1.7	40	28
Pronghorn	7,672	8,358	8.8	6.8	63	55	0.81	0.20	0.55	0.09	4.4	1.5	0.67	0.10	0.07	0.02	34	41	54	61	3.7	1.5	42	25
CDC Haymaker (check)	8,451	7,656	7.9	8.4	64	58	0.19	0.30	0.14	0.23	1.2	2.4	0.16	0.14	0.35	0.17	32	38	53	60	4.0	2.1	50	33
KWS ProPower + CDC Baler	7,046	6,548	9.2	9.9	60	59	0.29	0.32	0.14	0.26	1.8	2.8	0.21	0.16	0.18	0.12	36	37	55	58	3.8	2.7	44	43
CDC Arborg + CDC Maverick	7,611	8,770	8.1	7.2	67	61	0.19	0.30	0.13	0.19	1.2	2.1	0.17	0.15	0.23	0.06	29	35	48	55	4.1	2.2	50	36
CDC Austenson + CDC Haymaker	8,463	9,050	8.1	7.3	67	62	0.18	0.25	0.13	0.21	1.3	1.9	0.15	0.13	0.27	0.06	30	34	49	54	3.7	2.5	46	39
CDC Haymaker + CDC Horizon	7,394	6,568	9.1	11.1	64	57	0.37	0.53	0.14	0.29	1.4	2.5	0.20	0.17	0.30	0.13	33	39	46	58	3.8	2.7	42	43
CDC Haymaker + CDC Horizon + forage rape	7,127	6,457	8.4	11.0	60	58	0.35	0.44	0.13	0.25	1.6	2.3	0.20	0.19	0.33	0.21	36	38	55	57	3.9	3.2	47	51

At Redvers, monocrops were higher yielding than mixtures in 2020, but the opposite was true in 2021. For barley, oats and wheat, the check variety for each species was the highest yielding treatment each year, (Advantage, Haymaker and Innova). In 2020, the highest yielding treatment resulted from the check barley variety, Advantage (9,917 kg/ha) and the only varieties to yield higher than the check for all species were Pronghorn (7,672 kg/ha) and Bunker triticale (7,487 kg/ha). 2021 brought similar yields with few varieties out yielding the check (barley-oat mixtures, Pronghorn triticale, Plentiful wheat and

Maverick barley). Barley and oat yields were most affected by the extreme temperatures, high winds and below average precipitation for the area. Mixes followed the same trend with both barley-oat mixtures yielding well each year, similar to the Haymaker oat check variety and the fall rye mixture and pulse-cereal mixtures performed poorly at this location compared to the barley-oat mixture.

Top yielding varieties at Redvers in 2020 (CV=7.3%) from each species include:

- Advantage barley (9,917 kg/ha)
- Haymaker oat (9,140 kg/ha)
- Innova wheat (7,845 kg/ha)
- Pronghorn (7,672)
- Haymaker oat (8,451 kg/ha) Haymaker oat + Austenson barley (8,463 kg/ha)

Top yielding varieties in Redvers in 2021 (CV=11%) from each species include:

- Maverick barley (6,699 kg/ha)
- Haymaker oat (9,140 kg/ha)
- Plentiful wheat (6,825 kg/ha) and Innova wheat (6,816 kg/ha)
- Pronghorn triticale (8,358 kg/ha)
- Haymaker oat + Austenson barley (9,050 kg/ha)

Prince Albert preliminary results (table 8)

Plots at Prince Albert were seeded May 17th, similar to 2020, but harvest varied and took place 1-2 weeks earlier in 2021. Plots were seeded into good moisture, but were slow to emerge due to cool temperatures through to the end of June. Barley took the biggest drop in yield in 2021 as a result of the low precipitation, extreme heat and drying winds, but most treatments were lower yielding than the previous year. As a result of an earlier harvest, less heat damage occurred (ADIN) and resulted in a higher quality feed in 2021 compared to 2020.

- Crude Protein was higher in 2021 (7.2-9.6%) compared to 2020 (6.2-8.8%).
- TDN was high both years ranging from 61-74%.
- ADF suggests high forage intake each year with values ranging from 23-33%.
- The nutrient analyses suggest most treatments were low in calcium (Ca), phosphorus (P), and Magnesium (Mg) and may need to be supplemented.

Table 8. Yield and nutrient analysis, Prince Albert 2020-2021.

Year	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021				
Prince Albert	Yield (kg/ha)		CP		TDN		Ca		P		K		Mg		Na		ADF		NDF		ADI-CP		ADIN	
AB Advantage (check)	8,126	3,370	8.1	8.3	72	70	0.20	0.24	0.25	0.20	1.1	1.5	0.17	0.18	0.11	0.05	25	27	44	47	6.7	3.5	82	56
CDC Maverick	9,397	6,829	8.8	7.4	74	67	0.16	0.28	0.30	0.18	0.9	1.4	0.16	0.19	0.06	0.06	23	29	40	49	7.2	3.6	81	57
CDC Cowboy	8,993	5,683	7.2	7.5	68	68	0.17	0.23	0.26	0.19	1.1	1.4	0.16	0.19	0.08	0.07	28	29	48	48	6.4	3.7	88	59
AAC Synergy	7,876	3,473	7.8	8.2	73	72	0.16	0.27	0.24	0.20	1.0	1.2	0.14	0.17	0.04	0.04	24	25	42	43	6.0	3.1	77	49
CDC Bow	8,085	2,693	7.8	8.7	74	71	0.16	0.27	0.26	0.18	0.9	1.2	0.17	0.17	0.10	0.05	23	26	40	45	6.7	2.8	87	44
CDC Fraser	7,605	4,414	7.0	8.5	70	70	0.16	0.23	0.22	0.18	1.1	1.5	0.14	0.17	0.09	0.08	27	27	45	48	4.0	3.5	57	55
CDC Haymaker (check)	9,131	8,189	7.1	8.8	66	63	0.15	0.27	0.24	0.15	1.3	1.9	0.14	0.16	0.03	0.32	31	33	51	56	3.9	2.0	56	32
Ore3542M	8,481	9,572	7.5	8.6	70	67	0.13	0.23	0.25	0.17	1.4	1.5	0.14	0.16	0.08	0.40	27	29	47	50	3.6	2.0	48	32
CDC Ruffian	8,916	6,716	7.1	9.6	68	69	0.14	0.22	0.24	0.18	1.5	1.5	0.15	0.14	0.05	0.25	28	28	44	45	3.9	2.7	55	43
SO-1	6,586	7,953	6.2	9.4	64	69	0.17	0.25	0.22	0.16	2.2	1.5	0.15	0.16	0.11	0.24	33	28	53	49	4.0	2.5	64	41
CS Camden	7,840	7,341	6.6	9.0	64	68	0.17	0.25	0.22	0.17	1.9	1.4	0.16	0.16	0.06	0.21	32	28	51	48	3.5	2.1	57	33
AAC Innova (check)	9,003	6,359	6.9	8.7	68	70	0.08	0.14	0.21	0.15	1.2	1.2	0.12	0.14	0.01	0.02	28	27	47	46	3.1	2.1	45	34
CDC Plentiful	7,821	7,330	7.9	8.6	68	67	0.09	0.15	0.23	0.16	1.2	1.3	0.11	0.12	0.01	0.01	29	29	46	49	3.4	2.8	44	45
Pasteur	9,132	6,965	7.3	8.9	70	69	0.09	0.16	0.20	0.15	1.0	1.2	0.12	0.15	0.01	0.01	27	28	46	47	3.8	2.8	51	46
Sadash	8,552	7,342	6.9	8.6	66	71	0.09	0.14	0.19	0.15	1.3	1.5	0.11	0.12	0.01	0.01	31	26	49	45	3.3	2.6	49	41
Taza (check)	8,130	8,656	7.2	6.6	65	63	0.09	0.16	0.22	0.14	1.1	1.4	0.11	0.10	0.01	0.01	32	33	51	54	3.2	2.6	45	42
Bunker	7,286	8,738	7.7	8.7	66	66	0.09	0.15	0.23	0.17	0.9	1.0	0.12	0.13	0.00	0.01	31	30	49	51	3.0	3.2	39	50
Pronghorn	7,684	9,374	6.7	7.9	70	67	0.08	0.18	0.23	0.15	1.0	1.3	0.11	0.13	0.01	0.01	27	29	45	49	3.0	3.1	45	50
CDC Haymaker (check)	8,509	7,670	6.7	9.2	64	64	0.16	0.26	0.23	0.16	1.6	1.7	0.15	0.16	0.04	0.27	32	32	51	56	4.9	1.9	72	31
KWS ProPower + CDC Baler	8,070	7,300	6.7	8.9	63	67	0.19	0.30	0.19	0.16	2.0	2.2	0.15	0.18	0.15	0.13	33	30	54	51	4.1	2.2	60	35
CDC Arborg + CDC Maverick	6,181	7,233	6.7	7.2	68	68	0.17	0.28	0.23	0.15	1.4	1.5	0.17	0.18	0.14	0.13	29	29	50	48	4.8	2.8	69	45
CDC Austenson + CDC Haymaker	5,953	7,060	6.6	8.6	66	69	0.14	0.25	0.26	0.17	1.7	1.4	0.15	0.16	0.06	0.16	31	27	49	49	5.0	2.4	75	38
CDC Haymaker + CDC Horizon	6,524	4,644	7.2	9.0	61	63	0.28	0.46	0.21	0.18	1.8	1.9	0.17	0.18	0.07	0.12	35	33	54	56	5.8	2.4	81	38
CDC Haymaker + CDC Horizon + forage rape	6,378	6,463	7.2	8.6	64	65	0.26	0.40	0.23	0.17	1.7	1.6	0.18	0.16	0.08	0.12	32	32	52	53	4.7	1.7	64	27

Barley monocultures resulted in the largest yield reduction as a result of the low precipitation, extreme heat and drying winds, but most oats, triticale and mixtures were lower yielding than the previous year as well. In 2020, the highest yielding treatment resulted from Maverick barley, with a 16% increase over the check variety. The only other varieties that out yielded the check variety at Prince Albert that year were Cowboy barley (11%) and Pasteur wheat (1%). In terms of barley yield each year, Maverick seems to be the most suited to the area, followed by Cowboy. The Haymaker oat check variety for the mixtures out-yielded all mixtures each year, and was followed by the fall rye and oat mix. Prince Albert seems to be the best-suited location for the fall rye and oat mixture. In terms of the pulse-cereal mixtures, the forage rape seems to have increased the pea oat mixture yield substantially at this location in 2021.

Top yielding varieties at Prince Albert in 2020 (CV=12.6%) from each species include:

- Maverick barley (9,397 kg/ha)
- Haymaker oat (9,131 kg/ha) and mixture check (8,509 kg/ha)
- Pasteur wheat (9,132 kg/ha)
- Taza triticale (8,130 kg/ha)

Top yielding varieties in Prince Albert in 2021 (CV=20.1%) from each species include:

- Maverick barley (6,829 kg/ha)
- Ore3542M oat (9,572 kg/ha)
- Sadash wheat (7,342 kg/ha), Plentiful wheat (7,330 kg/ha)
- Pronghorn triticale (9,374 kg/ha)
- Haymaker oat (7,670 kg/ha)

12. Conclusions and Recommendations

In the first 2 years of this demonstration, producers had an opportunity to see how these crops established in their own region, specifically the cereal-cereal and cereal-pulse mixtures. They were also introduced to potential options for these varieties to be established as either grain, or livestock feed in comparison to those varieties that have specifically been bred for forage production. Based on the results of this project a

number of varieties included would require supplementation in order to meet nutritional requirements. The resulting calcium to phosphorus levels were often low and high potassium along with low calcium and magnesium can all cause predispose animals to winter tetany (death). Since forage quality is dependent on field conditions and differs from year to year according to species, stage of maturity at harvest, weathering, storage conditions, plant disease and many other factors, it is important to test feed annually (BCRC) and ensure the feed source being used is appropriate for a specific operation. All varieties had TDN values well above 55% and suggest the potential to be high energy feed sources. ADF results suggest good digestibility and high forage intake and do not exceed 40%. NDF remained below 55% for all treatments, therefore no variety from this test is expected to be of low quality, nor restrict animal intake.

Although yield results varied by site-year, barley, oats and triticale as well as most forage mixtures often remained consistent in providing sufficient yield compared to spring wheat. Some specific varieties such as Maverick barley, Haymaker oat and Pronghorn triticale were generally higher yielding than other varieties and have shown to be successful across various locations. The fall rye mix, although high in protein, tended to be lower yielding, but offers other benefits, such as continuing to grow and be an available feed source after the first cut for further grazing. Barley-oat mixtures performed well across most regions followed by pulse-cereal mixtures, but some variation is seen between soil types and environments and it is important to choose the mix most suited to your region. There may also be advantages in considering commodity prices of each species, in the case that the crop is not needed for forage, but rather harvested and sold as grain. Based on preliminary results many of these annual varieties have potential to be suitable feed sources and can provide high forage intake. Although environmental conditions were less than ideal most site years we were still able to obtain valuable information about each variety and location.

Supporting Information

13. Acknowledgements:

- This project was supported by the Strategic Field Program (SFP) initiative under the Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture.

14. Extension Activities and Dissemination of Results

- This trial was featured each year on a weekly radio program called, “Walk the Plots” that airs weekly throughout the summer.
- Preliminary results were discussed by Amber Wall at the Ministry of Agriculture planning meeting September 22, 2020 in Humboldt, SK, as well as by Terry Kowalchuk as a part of the Virtual Agronomy Research Update in December 2020.
- Amber and Terry discussed results at the Forage Advisory meeting on November 10, 2021
- Amber presented an update on this trial at the Agri-ARM Research Update (ARU 150+ participants), January 10, 2022 and the Federated Coop (FCL) Forage Week (85+ participants), February 16, 2022.

- Other small tours for of a total of approximately 30 producers and agronomists visiting the site throughout the season at Swift Current.

Abstract

15. Abstract/Summary:

- In the spring of 2020 and 2021 a trial was established in Swift Current, Clavet, Prince Albert and Redvers titled “An Assessment of Annual Forage Varieties in Saskatchewan.” This project consists of a 3-replicate demonstration with 24 different treatments all of which were seeded and harvested. The objective of this project is to evaluate and compare commonly grown and commonly available varieties of barley, oats, wheat, triticale and some mixtures for forage yield and quality along with newer crop varieties for their potential as annual forages. Since forage quality is dependent on field conditions and differs year to year according to species, stage of maturity at time of harvesting, weathering, storage conditions, plant disease and many other factors, it is important to test feed annually (BCRC). Multiyear, multisite data is required to make any recommendations about the performance of common annual cereal varieties in order to help producers make more informed decisions. This trial was brought to the attention of multiple small group tours throughout 2020 and 2021 (following COVID-19 restrictions) and was also promoted on a CKSW radio program titled, "Walk the Plots" which is broadcasted on a weekly basis throughout the summer.

17. Appendices

Table 9. 8-site year averages and overall averages per species for each data point collected (2020-2021, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Crop	Days to Heading	Lodging Score (1-9)	Forage DM Yield (kg/ha)	Feed Analysis											
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	ADI-CP (%)	ADIN (%)	K (%)	RFV	Na (%)	Mg (%)
8	AB Advantage (check)	Barley	62	1	6,956	9.9	29.7	49.5	66.9	0.26	0.19	3.62	28.03	1.51	130	0.20	0.20
8	CDC Maverick	Barley	62	1	7,751	9.0	28.9	48.3	67.8	0.24	0.19	3.73	28.52	1.32	134	0.17	0.19
8	CDC Cowboy	Barley	61	1	7,434	9.0	30.2	50.0	66.3	0.23	0.19	3.44	28.09	1.46	128	0.21	0.20
8	AAC Synergy	Barley	62	1	6,769	9.2	28.1	46.9	68.6	0.27	0.18	3.61	29.70	1.22	140	0.15	0.18
8	CDC Bow	Barley	63	1	6,747	9.2	29.5	49.0	67.1	0.29	0.18	3.68	31.21	1.28	134	0.15	0.18
8	CDC Fraser	Barley	63	1	6,748	9.3	29.8	49.9	66.8	0.23	0.18	3.58	26.01	1.41	129	0.17	0.18
8	Overall Barley Average	Barley	62	1	7067	9.3	29.4	48.9	67.2	0.25	0.18	3.61	28.59	1.37	132	0.17	0.19
8	CDC Haymaker (check)	Oat	61	1	7,656	9.6	33.9	56.5	62.4	0.22	0.19	2.62	19.37	1.96	106	0.30	0.17
8	Ore3542M	Oat	57	1	7,487	9.3	31.4	52.7	65.1	0.19	0.21	2.63	18.95	1.80	118	0.37	0.17
8	CDC Ruffian	Oat	58	1	7,228	9.7	32.4	51.6	64.0	0.21	0.20	2.85	19.16	1.89	121	0.30	0.16
8	CDC SO-1	Oat	57	1	6,840	9.4	30.8	52.5	65.7	0.24	0.19	2.70	20.40	1.94	118	0.30	0.19
8	CS Camden	Oat	57	1	6,661	9.6	32.6	52.4	63.8	0.23	0.19	2.81	20.08	1.93	118	0.26	0.18
8	Overall Oat Average	Oat	58	1	7174	9.5	32.2	53.2	64.2	0.22	0.20	2.72	19.59	1.90	116	0.31	0.17
8	Taza (check)	Triticale	56	1	6,974	9.1	31.9	52.5	64.6	0.16	0.19	2.82	20.06	1.46	118	0.01	0.13
8	Bunker	Triticale	56	1	6,717	9.3	32.4	52.5	64.1	0.25	0.24	2.87	19.77	1.59	117	0.01	0.20
8	Pronghorn	Triticale	56	1	7,305	9.0	30.5	49.9	66.0	0.25	0.23	2.77	21.26	1.75	128	0.04	0.22
8	Overall Triticale Average	Triticale	56	1	6999	9.1	31.6	51.7	64.9	0.22	0.22	2.82	20.37	1.60	121	0.02	0.18
8	AAC Innova (check)	Wheat	59	1	6,670	9.6	31.4	52.0	65.0	0.14	0.17	2.51	19.35	1.43	120	0.02	0.15
8	CDC Plentiful	Wheat	59	1	6,366	10.5	30.2	51.2	66.4	0.17	0.18	2.66	18.75	1.32	126	0.02	0.16
8	Pasteur	Wheat	57	1	6,009	10.2	30.7	49.4	65.8	0.15	0.19	2.76	19.06	1.41	131	0.01	0.13
8	Sadash VB	Wheat	58	1	6,525	9.9	30.8	51.2	65.8	0.14	0.17	2.69	20.91	1.50	124	0.02	0.15
8	Overall Wheat Average	Wheat	58	1	6392	10.0	30.8	50.9	65.8	0.15	0.18	2.66	19.52	1.41	125	0.02	0.15
8	CDC Haymaker (check)	mixture	59	1	7,614	9.8	33.4	55.3	63.0	0.24	0.20	3.12	25.44	2.06	107	0.21	0.17
8	KWS ProPower+CDC Baler	mixture	61	1	6,679	9.7	32.6	54.5	63.8	0.26	0.20	2.86	21.68	2.21	110	0.15	0.18
8	CDC Arborg+CDC Maverick	mixture	59	1	7,444	9.1	29.6	49.4	67.0	0.24	0.19	3.51	26.94	1.71	128	0.15	0.18
8	CDC Austenson+CDC Haymaker	mixture	61	1	7,552	9.6	30.4	51.0	66.2	0.22	0.20	3.11	26.71	1.84	121	0.12	0.16
8	CDC Haymaker+CDC Horizon	mixture	61	2	6,985	10.5	33.5	53.6	62.8	0.39	0.21	3.17	23.55	2.10	111	0.15	0.19
8	CDC Haymaker+CDC Horizon+forage brassica	mixture	60	2	7,043	10.4	33.6	54.5	62.7	0.35	0.20	3.31	23.85	2.03	108	0.19	0.19
8	Overall Mixture Average	mixture	60	1	7220	9.9	32.2	53.0	64.3	0.28	0.20	3.18	24.69	1.99	114	0.16	0.18